



TRAINEE REVIEW ARTICLE

## Slowing Myopia Progression in Childhood: A Guide for The Pediatrician

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Myopia, or the refractive state of being near-sighted, is an ever-increasing public health burden. Believed to be due to both inherited and environmental factors, myopia is predicted to affect 49.8% of the world's population by 2050, with pathologic myopia (high myopia that places an eye at a significantly increased risk of having a retinal tear or detachment) predicted to affect 9.8% of the population.<sup>1</sup> Being myopic could set that child up for social difficulties, financial strain on their family, and even long-term ophthalmologic surgical complications. A near-sighted kindergartener is likely to get much more near-sighted before they are done growing. The pediatrician is often a child's first eye screening; thus, the burden frequently falls on the pediatrician to first notice the refractive problem and send the child to the correct provider. Because of this, it is imperative that pediatricians know that new evidence-based treatments are available to help slow myopia progression.

Myopia, or the state of being able to see near things but not things far away, is almost certain to continue to worsen throughout a child's school years. While those with myopic parents are more likely to have myopia themselves, research has shown that this is not the whole picture, and other risk factors contribute to a child's likelihood of being myopic. An individual with high myopia needs frequent eye screenings throughout life due to the high risk of developing complications. Patients with high myopia have a greater chance of developing cataracts, glaucoma, maculopathy, and retinal detachments. While counseling a patient on lifestyle changes could theoretically slow myopic progression, offering treatments available today through many pediatric optometrists and ophthalmologists could be life-changing for such a patient.

Several lifestyle choices are thought to worsen myopic progression and could be the reason that myopia is increasing in prevalence in the current technology-driven age. High intensity near work was found to correlate with increasing rates of myopia progression.<sup>2</sup> Additionally, more years of schooling or higher intensity of schooling is a known risk factor. While studies have shown that higher intelligence quotient scores are also correlated with myopia, some postulate that this is a confounding factor.<sup>3</sup> Currently, Asian-American children are the most likely to be near-sighted, followed by Hispanic-American children, Black-American children, and then Caucasian-American children.<sup>4</sup> Associations such as pollution exposure, hours of sleep, exposure to smoking, birth order or season of birth, and nutrition continue to be debated risk factors. Most importantly, myopic progression appears to be slowed significantly when a child spends enough time outdoors.<sup>5</sup> Indeed, increasing a child's outdoor time seems to override the impact of

many hours of near work, even if a child's parents are myopic. It appears that the benefit is most helpful when the child is becoming myopic rather than when a child is already progressing. Still, suppose a family is offered a referral for myopic progression treatment, and the family kindly declines. In that case, it may be prudent for the pediatrician to encourage outdoor time for 2 hours or more a day as an alternative.

The proposed mechanisms for myopic progression are outside the scope of this article; however, in summary, myopic progression is thought to be due in part to the focus (or rather lack of focus) of light on the periphery of the retina in a child. Multiple techniques to utilize this knowledge and prevent myopic progression have been attempted. Recently, myopia progression treatment has become safer and easier and thus should now be mentioned to myopic families.

Historically, orthokeratology (ortho-k) has been the leader in slowing myopic progression. Ortho-k is a corneal reshaping contact lens worn while a child sleeps. The contact lens reshapes the eye's surface, creating a treatment zone so that when the child wakes up and removes the lens, they do not need to wear glasses during the day. Originally designed to prevent children from needing glasses at school or for activities, ortho-k lenses were discovered to slow myopia progression. This form of myopia therapy is not fit for every patient due to cost, initial adaptation to the lens, and treatment limitations.

Other options for contact lenses worn during the day are soft multifocal contact lenses and dual-focus contact lenses. Soft multifocal lenses have 6-year data that show the benefits of safely slowing myopia. More recently, a soft contact lens called MiSight® by CopperVision has been FDA-approved and is available in the U.S. market. Using patented technology, this lens appears to change light refraction in two rings (termed "treatment zones") around the center of a patient's vision. This soft contact lens is worn during the day and taken out every night. Three-year data on MiSight® appears to show that it slows myopic progression similarly to ortho-k technology.<sup>6</sup> Soft contact lenses expose a wearer to risks of corneal ulcers, corneal scars, decreased vision, and long-term dry eye syndrome. Since children are less likely to follow proper use rules for wearing contact lenses, such as not sleeping while wearing the contacts, not swimming or showering while wearing the contacts, and disposing of the contacts in the recommended amount of time, it is imperative to select patients for this option correctly.

Two options remain for pediatric patients who are not eligible for contact lenses: atropine drops and special eyeglasses. A pediatric eye provider can start each treatment and can be mentioned to the pediatric patient's family by a pediatrician.

First, an eye drop is available to slow myopic progression. Atropine drops are a commonly used eye drop to dilate a patient's eye for an examination. While systemic absorption can cause bradycardia and other systemic problems, low-dose atropine drops are relatively safe for use in children. Originally, a drop of Atropine 1% given to children nightly was shown to slow myopic progression.<sup>7</sup> At this dose, however, children complained of glare symptoms, sensitivity to light, and difficulty with near work. Thus, since this study was performed, eye providers have been studying which dose and at which frequency can both prevent the child from experiencing these symptoms and slow or prevent myopic progression. Currently, most providers are utilizing one drop of low-dose atropine (either Atropine 0.05%, Atropine 0.025%, or Atropine 0.01%) to each eye nightly.<sup>8</sup> This treatment requires a referral to an eye provider and continues to be costly to the patient, as insurance does not yet cover this eye drop. There is also a rebound effect when atropine is abruptly stopped; therefore, proper education on compliance must be discussed.

Finally, a safe, easier, and (likely) more affordable method of preventing myopia will soon be available in the United States once it gains FDA approval. Three spectacle lens options are being studied with promising results. MiYOSMART glasses, manufactured by Hoya Vision, are "defocus incorporated multiple segment" glasses. These glasses are comprised of a clear central zone with a schematic array of defocused segments.<sup>9</sup> The Stellex™ lenses, manufactured by Essilor, use Highly Aspherical Lenslet Target (H.A.L.T.) technology. These lenses utilize a clear central zone surrounded by aspheric lenslets. The third option is Diffusion Optics Technology (D.O.T) lenses, offered by SightGlass Vision. This option has a clear central zone surrounded by multiple dots that reduce the contrast to the retina.<sup>10</sup> These three spectacle lenses provide a safe way for a child to slow their myopic progression without the risk of chronic contact lens wear or improper use of atropine. Additionally, having a child wear glasses is a much easier task for a parent than the many difficulties of having a child wear contact lenses or comply with eye drops. While more costly than a regular pair of glasses, these glasses may still be affordable to the average family and can easily be prescribed by any pediatric eye provider.

In summary, the pediatrician may be the ideal provider to initially mention the risks and complications of myopia progression with families. Increasing outdoor time, special contact lenses, low-dose atropine eyedrops, and special glasses have scientific evidence to slow myopia progression. We recommend early referral to an eye provider, even at a very young age, if myopic progression is a concern. Currently, many eye providers are not routinely offering myopia progression treatment or routinely discussing therapy options with each patient. Thus, pediatricians should refer to eye providers in their area who provide this service. Pediatricians have the unique opportunity to refer interested patients to a pediatric eye provider who could further discuss these available options, thus possibly preventing a lifetime of vision difficulties and ocular complications. For families not interested in myopic progression treatment, the pediatrician could use this discussion to encourage outdoor activities for two or more hours per day and limit screen time to 2 hours a day for the benefit of their patient. We believe that with pediatricians' help, we can better serve our myopic children.

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